



NTNU

TDT4136 - AI INTRO

Exercise 1

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1. The Turing test is determinines if an AI has a human-like intelligence. A human tester has a conversation, but whether the tester is talking to an AI or another human is not known to the tester. If an AI is able to convince the tester that it is human, the AI passes the Turing test.

2. Thinking rationally is using reasoning and logic. Acting rationally is using rational thinking to decide on an action.

A rational action can be taken without a corresponding rational thinking process, such as in the example of a reflexive recoil when touching a hot stove. No time is spent deliberating, another system takes immediate action.

3. The theory explains how to relate abstract logical to the real world. Real world actions can thus be rationalized by more abstract logic.

4. Performing a task by trying to increase performance AND decrease cost (increasing the performance/cost ratio). Requires that these are somehow quantifiable.

"A rational agent chooses whichever action maximizes the expected value of the performance measure given the percept sequence to date."

5. (a) Assuming the robot has used the observation methods in it's action portfolio first, and made the decision to cross the road based on what it observed, the robot has acted rationally. Since the helicopter crash cannot be predicted by the robot based on it's observations, we cannot put any 'blame' on it and claim it acted irrationally.
(b) In this case the car should be within the observational range of the robot. However, the green light is also observable, and the robot would rightfully assume that the car (another agent) would follow the rules of the traffic light. Thus, the action of crossing the road on a green light seems rational.
6. (a) The simple reflex agent cannot be rational in this case because it doesn't track state in any way, such as whether it has already visited a tile. Thus it would go left and right over and over and lose many points.
(b) The reflex agent with state can be rational, as it can evaluate the first tile and clean if neccesary, then move to the other one and clean it if neccesary, then know it is done and not lose any more points.
(c) If the simple reflex agent can detect the state of the tiles in entire "universe" it operates in, then it can act rationally, because it can have a stop condition. See code in listing.

Listing 1: Algorithm (python-like)

```
1         while (A_is_dirty or B_is_dirty):
2             if location == A:
3                 if A_is_dirty:
4                     suck()
5
6                 if B_is_dirty:
7                     right()
8             else:
9                 if B_is_dirty:
10                    suck()
11
12                if A_is_dirty:
13                    left()
```

7.
 - Partially observable. Because the robot can only sense the tile it is in.
 - Single agent. There is only the robot acting on the environment.
 - Deterministic. The cleaning operation will always succeed if it is started.
 - Episodic. The robot bases it's decision only on the current tile's state.
 - Static. The tile will not change while the robot is deliberating.
 - Discrete. The tiles are separate and there is no "in between".
 - Known. The robot knows that the tiles only have two possible states.
8. (a) Simple reflex agents
 - Easier to implement.
 - Not very intelligent, can easily get stuck in infinite loops.
- (b) Model-based reflex agents
 - Can avoid many of the problems of simple reflex agents by remembering state and reaching an end condition.
- (c) Goal-based agents
 - More flexible.
 - Can have the concept of a compound goal and track the progress towards achieving this.
 - Can consider multiple solutions to the problem and naïvely pick the best.
- (d) Utility-based agents
 - Good in environments where optimization is possible.
 - Can consider multiple solutions, their costs, and pick the one which solves the problem for the lowest cost.